Chapter 1

Why argue about normative theories?
(involve arguments over predictions, in crude empirical theories; or recommendations; or variables to be included, measured, and processes of measurement).

CHAP II

Sets of numbers not unique

Ramsey, Savage, vonNeumann and Morgenstern theories, Marschak: deduce Bernoulli theory as a theorem; therefore, action violating it violates one or more of their axioms.

Axioms interpreted normatively; person who knows only that he has violated Bernoulli theory may not reverse choice; but when he knows he has violated one of their axioms.....New answer for "Why should he obey this theory?"

Also, they answer question: Why expectation? Why not range, variance, etc.?

They prove that some function exists such that its expected value corresponds to actual preferences; not that any given function (e.g., money) will.

But it is also clear how functions may be found. Since only two variables (prior theory determining variables to be measured) they could be determined from choices: if one can be held constant, or is "known."

If probs are "known": vN-M. Give Marschak axioms, or Samuelson. Measure utility for Bernoulli example.
If utilities are known: e.g., if utility is linear on money...
Bayes, de Finetti

But Bernoulli objection.

Possibility: measure some utilities with known probs, then measure probs;

Essentially Ramsey device; start with measuring prob = $\frac{1}{2}$ by a device that doesn't require you to know utilities of outcomes; but this same device could be used to measure all probs; Savage uses.

Chapter 3

Intuitive Probabilities and Vagueness

The logic of degrees of belief ; start with this approach because it utilizes concept of vagueness, which defines our field of interest.
Keynes: necessary view (later repudiated); but developed logic, assuming partial ordering. Convert vague knowledge into more definite; but how definite?

Koopman: logic, intuitively given (same test as Savage); partial ordering. n-scale; numerical representation of "vagueness," nature of partial ordering. (if complete ordering, all probs appraisable).

Knight: assumes appraisable; but concept of CONFIDENCE

Good: same notion of "vagueness" (contrary to Keynes' notion that probs don't "exist") partial ordering; emphasis that it is to be expected.

Why vagueness? a) incomparability of evidence (e.g., favorable or unfavorable evidence to a hypothesis, or between hypotheses); b) Weight of Arguments; c) conflict of evidence (e.g., among forecasters). d) imprecision of intuition (Savage)... (e) varying confidence (Savage, Knight, Keynes: how to apply?)

Note distinction between imprecision of upper and lower probs, and interval between upper and lower probs.

CHAPTER 4

Decision rules for acting, given vagueness:

1) minimax 3) Shackle. 4) Hurwicz
2) minimax regret.

Counterexamples. Degrees of belief relevant to decision, even when "vague."

3) Hurwicz, Good, Bross — notion of "conservatism," prudence
4) Hodges and Lehmann — notion of "confidence"
5) randomize(Keynes, Smith)
6) conventional: e.g., midpoint of interval:
7) FIND, if possible, probs such that you do obey Bernoulli hypothesis.

Even without vagueness, different decision rules possible:
a) max expected utility
b) max function of expected (money, or some other index not vN-M utility); (wouldn't obey vN-M axioms on basis of <u>these</u> probs; wouldn't follow Bernoulli)
c) look at most probable outcome

Which are reasonable? Good conjecture, for case of vagueness (Bernoulli, for non-vague).

Chapter ~~4~~ 5

Ramsey-Savage suspicion of preceding approach.

Measurement by bets, like Bayes, but avoiding utility problems:
Ramsey: measure prob=$\frac{1}{2}$, then measure utilities, then measure more probs.

Savage: measure probs, then utilities. Measure probs using only payoffs 1,0.
Conditions under which this will lead to probs; postulates specify these;
Use of "n-scale" to get numerical probabilities.
Postulates interpreted as normative.
Also yield utilities.

Get complete ordering of events, in terms of qualitative probabilities.
Hence, if n-scales exist, or given P6, get numerical probs in all cases

Rule out most of rules mentioned earlier, ~~if~~ under vagueness; shown in next chapter.

Chapter 6

Examples involving vagueness, ambiguity.

Two-urns-in-one
Red, Yellow, Black

problem of suspicion of experimenter

Four colors in each urn, two urns in one; 3 vs 3; 1 vs 1

Can't infer ~~probs~~ definite probs (Later conclude: could infer upper and lower probs--especially if, as Good suggests, he supports this inference by verbal statements.)

Chapter 5

Examples involving vagueness.

Chapter 7

What are you doing?

Not minimax, minimax regret, Hurwicz,

But look at hypotheses based on vague, interval probabilities;
Behavior corresponds to these, in terms of hypothetical upper and lower probs
Moreover, upper and lower probs needn't be hypothetical; can be estimated from conditions of information and verbal statements; values of can then be estimated or again inferred from verbal statements.

Can give meaning, in terms of this behavior, and measurement, to concepts of confidence, ambiguity (r, Y°) conservatism. (not pessimism: action <u>like</u> pessimism).

Ellsberg rule for explaining four-color case.
Shows all other rules as special cases, including Savage; but more important, explains behavior that none of them can.

Chipman results.

Nature of utility. Gambling Personalities.

Chapter 8

Suppose utilities are known. Use "Bayes'" method to:
Measure upper and lower probabilities.
Measure degree of ambiguity: show chart.
Thus, upper and lower probabilities could be meaningful in absence of any verbal statements of "intuitive probabilities"; and could be used to predict behavior.

Or, suppose some probabilities are known (Fellner); same
GOAL: modification of Sure-thing Principle, axioms to generate this behavior (e.g., without verbal statements as evidence); conjecture.
Principle of coherence: rules out "excess of boldness." But not conservatism.
(Savage, lately; de Finetti; Ramsey; Shimony; Lehmann; etc. are all wrong).
Smith; show assumption they all make.

Conservatism as preference not to bet, at certain odds, in ambiguous situation, on either side.
Keynes. "Lack of confidence."

Defects in principle of coherence.
~~Possible advantages of boldness~~

Possible advantages of boldness: warfare (Clausewitz; use probs); guerrilla war (Guevara); innovation, R&D, development (Knight), Keynes.
But questions: a) whether this benefits individual, or "society" ("organization"); b) whether advantage lies with boldness to the point of "incoherence," or whether it merely calls for some attention being paid to "best guess" and/or "best possible" (so as not to be paralyzed by ambiguity).

Likewise, possible disadvantages of conservatism: in buying information, basic research.
Again, question whether conservatism is bad, or excess of it.

Chapter 9

Violations of utility axioms; when prizes are ambiguous strategies.
Winning at Russian Roulette.
Raiffa, Pratt.

Dominance not involved;
~~Sure-thing Principle~~ P4
Strong independence axiom.

Problem of finding prizes that are not ambiguous: Marschak.
Basic test: domination (where "states of nature" are defined strictly)
Or test: prizes are such that Independence Axiom does hold ("Would your preferences be affected by a lottery between these prizes?")
Many of consequences Marschak mentions could not be assigned definite utilities by this test.

Also: to measure utility, must have unambiguous probs; Ramsey use of "~~equally probable~~ prob = $\frac{1}{2}$" might fail.

Chapter 10 Summary and suggestions for application

Evidence for reasonableness

Applications: a) measurement of upper and lower probs, conservatism, etc. tolerance of ambiguity. Gambling Personalities.
b) Value of information: could be greater or less for conservative.
c) Model of optimism, pessimism; wishful thinking, in presence of ambiguity and importance. tolerance of ambiguity.
d) games, bargaining, conflict

e) concept of insurance (under ambiguity). Flexibility.
Systems analysis. AJW.